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INNOVATION NETWORKS AND THE DEVELOPMENT OF CONSUMER-DRIVEN ICT-BASED MANAGEMENT SYSTEMS

ABSTRACT

This paper examines the use of consumer-driven innovation networks within the UK food retailing industry using qualitative interview-based research analysed within an economic framework. This perspective revealed that by exploiting information gathered directly from their customers at point-of-sale and data mining, supermarkets are able to identify consumer preferences and co-ordinate new product development via innovation networks. This has been made possible through their information control of the supply-chain established through the use of transparent inventory management systems. As a result, supermarkets e-business systems have established new competitive processes in the UK food processing and retailing industry and are an example of consumer-driven innovation networks. The informant-based qualitative approach also revealed that trust-based transacting relationships operated differently to those previously described in the literature.

INTRODUCTION

This paper considers the impact of Information and Communication Technologies (ICTs) on innovation within the UK food processing and retailing industry. In recent years, Britain's leading supermarket chains have successfully employed various elements of the e-business revolution to improve their services to customers. To date, however, the vaunted benefits expected to accrue from e-commerce (Hughes, 2002), in the shape of on-line shopping, have proved to be elusive. The leading exponent of this approach in Britain, Tesco plc, now holds 60 per cent of the UK internet grocery provision market, with annual sales currently valued at £365 million (Tesco, 2002). Whilst this amount is larger than the entire European market for online grocery sales (Keynote, 2002), it nevertheless represents only 1.7 per cent of Tesco's UK sales turnover. Rather, it has been through application of ICTs to other parts of their operations that Britain's supermarkets have been able to gain financial benefits and provide enhanced services to their customers. Specifically, by exploiting information gathered directly from their customers via scanning technology, and through the use of inventory management software systems, the UK supermarkets have been able to benefit directly from a strategy of new product development. In pioneering these innovations, Britain's leading grocery retailers have created a web of inter-firm alliances and networks that have served to transform relationships within the industry's value system.

Knowledge about the requirements of customers can be a strategic asset (Stata, 1989) and the rhetoric of e-business places a strong emphasis on the competitive advantages that firms can gain in the digital economy from integrating this information into their business systems (Moorman, Zaltman and Despande, 1992). Rowley (2002) reviews customer knowledge management that places the emphasis not on the information *per se*, but on the use of that information within organisations. By focusing on the UK food industry this paper offers an example of a particularly consumer driven sector in order to highlight how e-business systems have allowed supermarkets both to gather information, which is used to control the organisation of business, and to turn this information into knowledge which can be exploited in various contexts. This process has made its greatest impact on the

vertical relationships within the industry, where retailers have used inventory management systems to gain an intimate knowledge of suppliers' routines and costs. Supermarkets have also refined their ability to exploit data-gathering systems both to reveal and satisfy customer demand through their control of consumer information. The food industry is an archetypical multidomestic industry with consumers having widely varying tastes both between and within nations (Wright, Nancarrow and Kwok, 2001) and consumer-driven systems of innovation are especially effective in markets where consumer requirements are constantly changing, or highly segmented. Studies in the 1980s by Senker (1986; 1988) showed that the impetus for innovation in processed food was beginning to move from branded manufacturers to retailers and this shift has been quickened by the introduction of generic-ICTs (Cox, Mowatt and Prevezer, 2002) and led to the creation of sub-industries such as the chilled-ready meals segment which are outcomes of the changes made possible by e-business systems. This paper therefore focuses on this segment as a specific example of the impact of consumer-driven e-business systems in the UK grocery sector.

METHODOLOGICAL APPROACH

This paper utilised an in-depth interview-based approach in order to understand the contemporary network relationships and the innovation process in the chilled ready-meals segments of the food-retailing sector. Building upon a thorough grounding of secondary sources of information we selected one of the value-chains in the industry centring on Retailer A[1], a leading player in the chilled ready-meals market. For the examination of the control of the supply-chain we interviewed the General Manager Development Consumer Europe and the Development Director, Europe, from logistics contractors which we termed M and N, and the Project Manager for Chilled and Perishable Goods in Retailer A. We built a similarly detailed picture of the innovation network in the sector through interviews with Retailer A's new product development section (principally the Senior Trading Manager for Fresh Foods) and representatives of supplier firms and contractors. Interlocking testimony was used to verify information given across interview subjects, which was particularly successful in this case because of the nature of the career path within the industry (there was

some overlap at times between actors simultaneously involved in both networks). The interviews had a built-in variety as it was common for actors to have experience at different stages of the value chain, and for retailers, contractors and suppliers to have worked for other companies in the sector.[2] In this way, and by a brief examination of the retailer innovation network of another food retailer, designated as Company E, the representative nature of the selected vertical chain was corroborated.

The analysis adopted a networks-based approach in order to conceptualise and analyse the operation of consumer-driven innovation within the supermarket sector, principally the economic network-theory approach developed by Mark Casson (Casson, 1997; Casson and Cox 1997), emphasising the centrality of information within an economic framework. This framework reorientates the transactions cost paradigm developed most effectively by Williamson (1975; 1985) which has been important for the economic analysis of firms, but also is able to incorporate sociological-based studies focussing on the relationships between specific actors allowing for a more sophisticated understanding of network processes within and between firms (for a review see Ebers, 1997, Grandori and Soda, 1995 and Grabher, 1993). The role of trust within these relationships is also considered in this interdisciplinary approach (Casson and Cox, 1997; also see Lane and Bachmann, 1998, for a review of trust in network organisations). This approach allowed an understanding of how the nature of control and organisation had changed within the relationships examined, and has been employed in studies of long-term shifts in competitive advantage in the food processing industry (Cox, Mowatt and Prevezer, 2002).

CONSUMER-DRIVEN INNOVATION

The Chilled Ready-Meals Segment

The principal technologies discussed in this paper are related to those developed in conjunction with bar-coding, including scanning and the capture of consumer information at point-of-sale (POS). Figure 1 gives an overview of the key developments in this area. In conjunction with initiatives introduced in the 1990s such

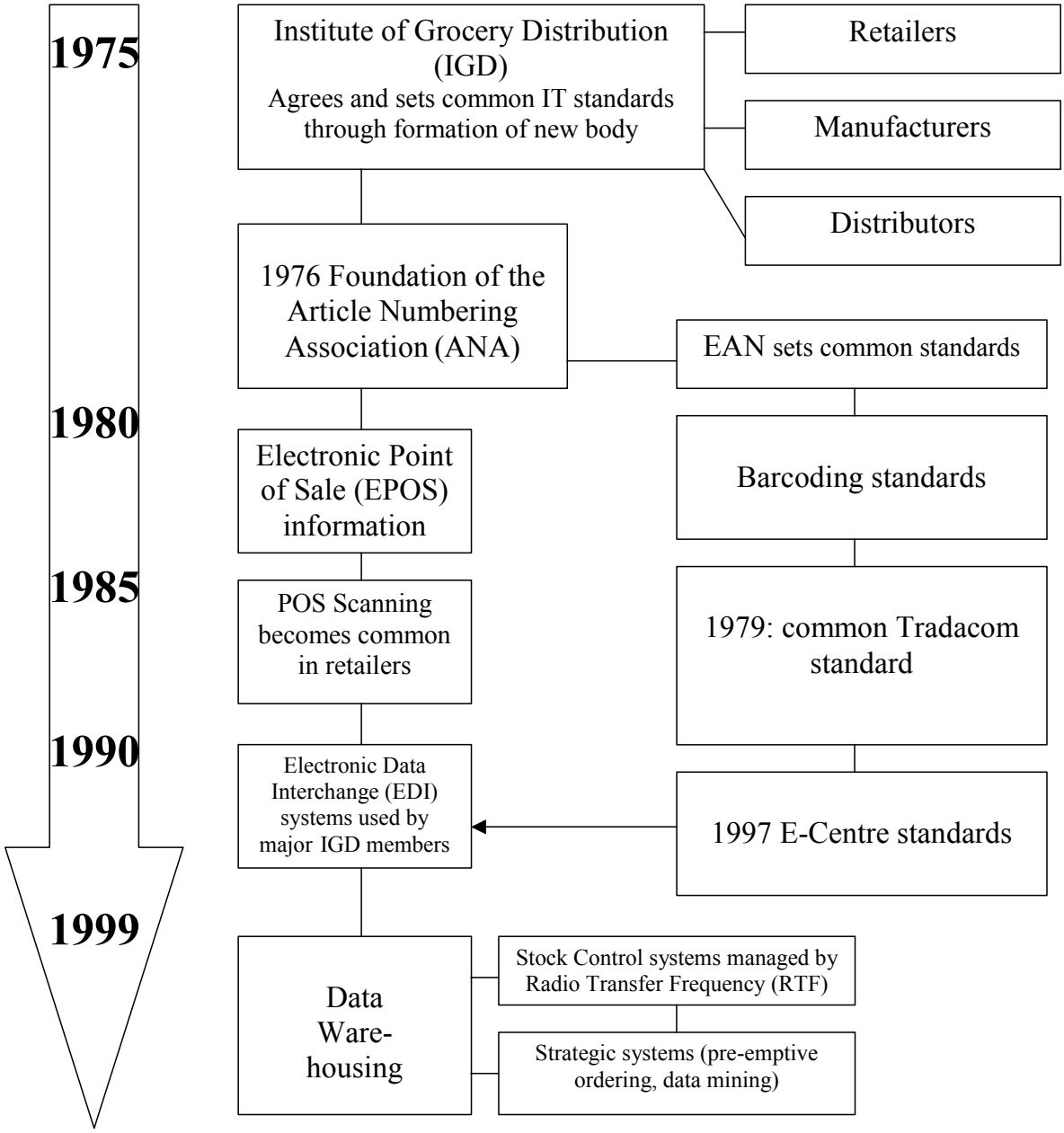

Figure 1: Development of IT systems in the food retail sector

as loyalty cards supermarkets have been increasingly able to assimilate information on purchasing patterns. Qualitative information through in-store activities and through marketing organisations has also helped develop knowledge of consumer trends and the increasing power and decreasing cost of computers since the mid-1990s has allowed supermarkets to invest heavily in data warehousing and mining facilities (see Dobbs, Stone and Abbott, 2002, for a review of the increasing penetration of data warehousing in the UK). Information is becoming ever more available to supermarket

retailers, but success has come when they are able to leverage this into new products or services.

The emergence of the chilled ready-meals segment within food retailing can be best understood in the context of two primary factors: the adoption by food retailers of new ICTs, and the system of relational contracting established by the clothing and foodstuffs retailer Marks and Spencer (M&S). M&S, describing itself as "a manufacturer without factories", was able to pioneer the chilled-ready meal product using organisational competencies in co-ordinating small suppliers, and these products have remained largely outside of the control of the large, branded food manufacturers. Subsequently, the introduction and exploitation of e-business systems by mainstream grocery retailers also allowed them to enter this high-value niche market, through their provision of own-label and own-brand goods.[3] Chilled ready-meals are the prime example of retailers' ability to differentiate quality own-brands, and are high value-added premium convenience products, which have displayed consistent rapid growth from the 1990s to date. They are ready-prepared complete meals or meal centres that need only heating by oven or microwave and are chilled, not frozen, for freshness. As the meals are highly perishable, and have a very limited shelf life, they require a sophisticated chill-chain which can deliver meals from manufacturer to point of retail in a few days in small batches.

The appeal of the sector lies not only in its convenience, but also as a substitute for takeaway and restaurant meals, and retailers therefore need to be able to offer their customer an expanding range of high quality products. Retailer A, for example, offered a total of 141 different chilled ready-meals in 2000, having introduced some 44 new products in 1999 alone. Retailers tend to source from a great number of suppliers in order to respond quickly to new restaurant trends with new recipes, exploiting the flexibility of small suppliers. Many of these small suppliers can only function through the co-ordination of the supermarkets supply-chain system, as they are too small to have marketing or sales functions of their own. Table 1 indicates the largest suppliers to the sector and gives some indication of their main customers. Maintaining a wide range of dishes is dependent on access to many specialist suppliers as the production of ready-meals spans different product-bases (poultry, fish, meats, vegetables), market segments (healthy eating, luxury, etc). and

ethnic recipes (traditional British, oriental, French, Italian, Thai, Tex-Mex). As Table 1 indicates, the specialist suppliers are mostly smaller companies, however each retailer sources from a core group of manufacturers. Northern Foods for example supplies about 30 per cent of M&S convenience foods and Hazlewood Foods produces 20 per cent of all chilled ready-meals. Because the major volume manufacturers have developed in conjunction with retailers, they often have an exclusive relationship with them.

Supplier	£m	Specialisation	Major Customer (Firm Specific Specialisation Indicated)
Northern Foods	1,285.9	General	M&S, Sainsbury's, Asda, Tesco
- Recipe Dish Company		General	M&S
- Cavaghan & Grey		Vegetarian / Fish / Poultry	M&S
Hazelwood Foods	788.9	General	Safeway, Tesco, Waitrose, Somerfield
Van de Bergh	763.8	Oriental	Tesco
Geest	522.1	General	Tesco (Indian), Sainbury's (Italian), Waitrose (British, Italian)
Sun Valley	268.0	Poultry	M&S
Bluecrest Freebooter	169.3	Fish	Tesco
Headland	164.0	General	Major supermarkets
S&A	60.13	Indian / Oriental	Asda, Waitrose, Safeway, Morrison
Katsouris	60.0	Indian / Vegetarian	Tesco, Waitrose, Somerfield
Marlow Foods	56.6	Quorn	Sainsbury's, Tescos
Noon Foods	52.1	Indian / Oriental	Waitrose, Sainsbury's
Pinney's	51.0	Fish	M&S, Sainsbury's
Oscar Mayer	42.6	General	Sainsbury's
Ferndale	25.0	Tex-mex	Asda
Ethic Cuisine	19.3	Vegetarian	Sainsbury's
Grampian Country Foods	15.4	Poultry	M&S
Perkins	12.8	Vegetarian	not.known
RF Brookes	9.0	Italian / Vegetarian	M&S
Daloon	8.3	Indian / Oriental	Major supermarkets
Cherry Valley	6.0	Poultry	Waitrose, Morrison

Table 1: Major Outside Own-Brand Suppliers in 2000.

Supermarkets' access to information allows them to exploit this data within different contexts. Figure 2 shows the supermarkets' control of information flows,

linking the supply-chain to the information about consumer demand derived ultimately from purchasing behaviour. Supermarkets are able to exploit this control to co-ordinate the supply of short shelf-life products such as chilled ready-meals and this is examined in later sections in more detail. This information control also puts retailers in the optimal position to gain marketing information directly from their intimate relationship with the customer through POS monitoring, customer loyalty schemes exploited by data mining and their own market research. Retailers can also exploit this control by identifying new market niches, filling them with new differentiated products as quickly as possible, and responding effectively to new eating trends. Retailers in the UK are able to co-ordinate the development of new products as they have internal hygiene and product development departments, even though they do not have any production capacity of their own (Fernie, 1997; Hughes and Merton, 1996; Senker, 1986, 1988). From control of the information systems retailers are able to co-ordinate the innovation process.

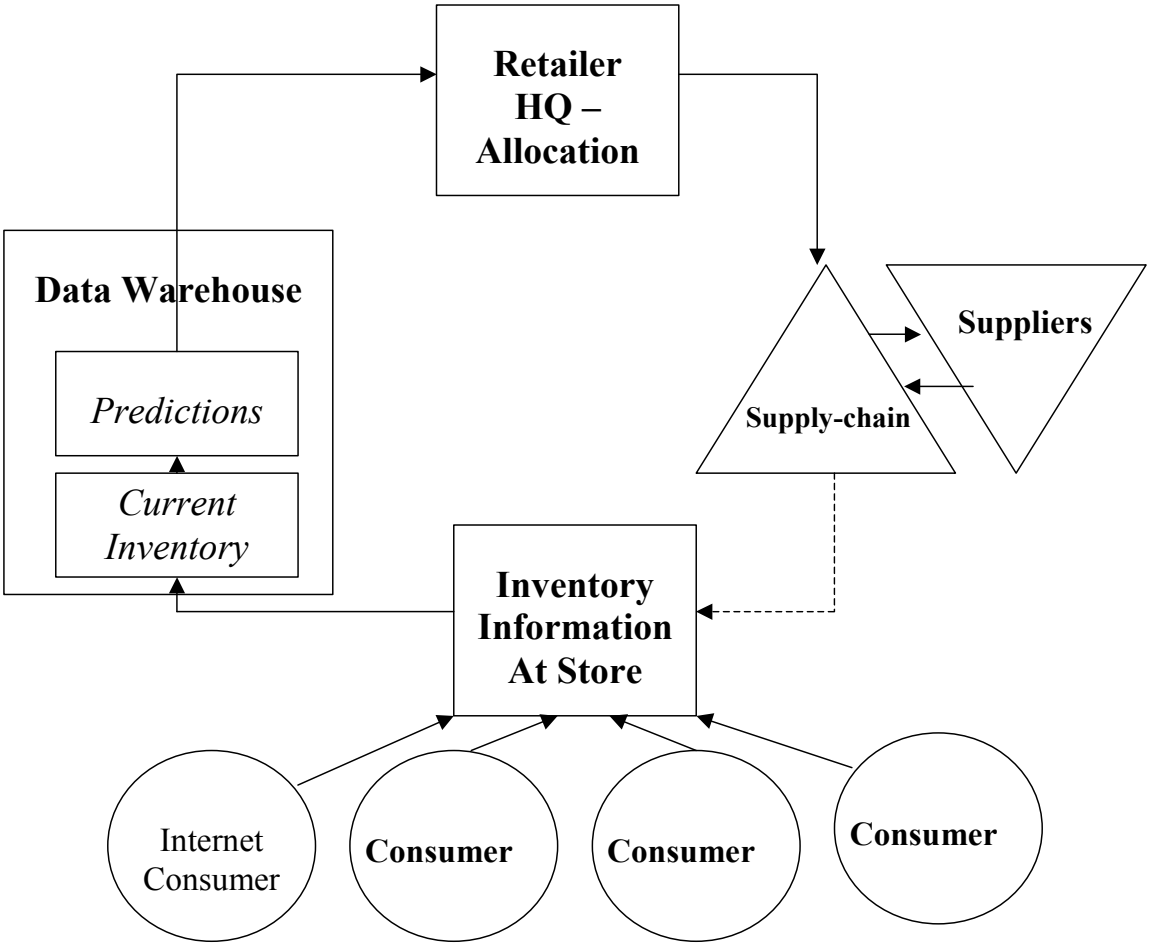

Figure 2: Supermarkets' Information System

Innovation through Strategic Alliances: Retailer A's Innovation Network

The consumer information which Retailer A collects is considered in conjunction with strategic alliance partners, whose activity is co-ordinated through the retailer's control of the supply-chain which we consider in the next section. Retailer A is an example of a firm that has been able to exploit its proximity to the consumer to develop and supply new products, deriving knowledge about consumer trends through the innovation network, especially from expert sources of information and small specialist companies. Retailer A accepts that "many new product ideas come from our suppliers and we work very closely with some of the top chefs … so we follow those consumer trends which are very fashionable." The relationships engaged in this sector are best understood as inter-organisational networks whereby manufacturers and packaging firms develop new products in conjunction with retailers. Figure 3 depicts the new product development network.

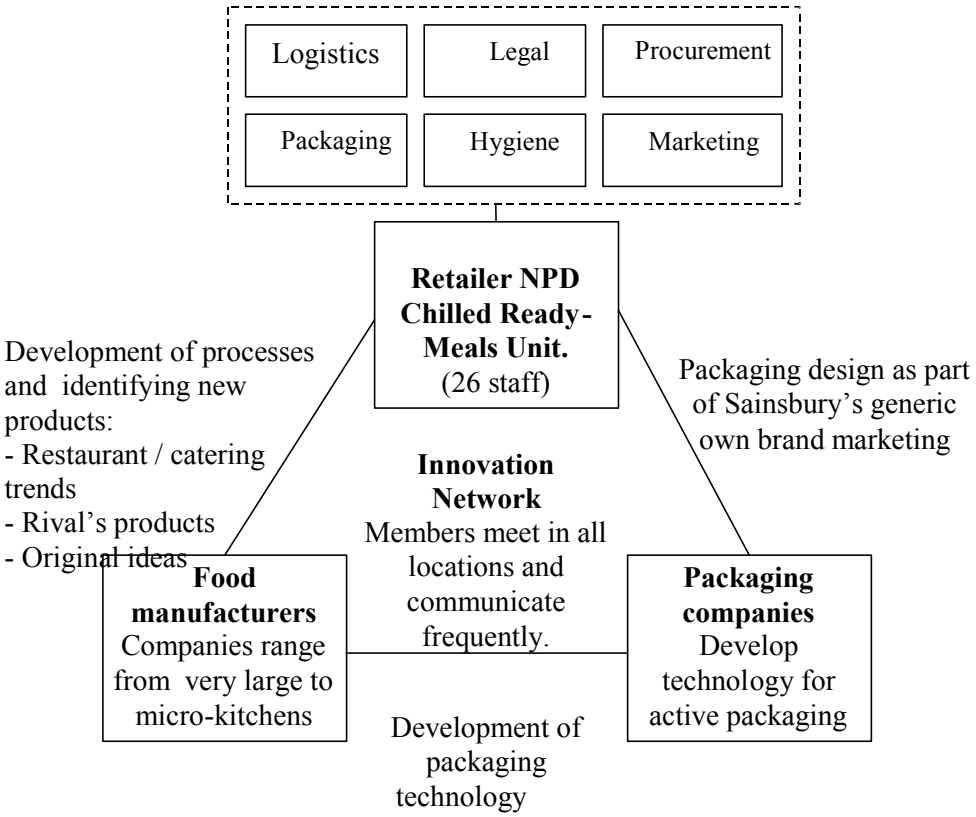

Figure 3: The Innovation Network

Retailer A claims to have a “very long term relationships with [its] suppliers”. Trust within long-term relationships is critical (Lane and Bachmann, 1998), as Retailer A has no capital stake in suppliers and there are few formal contracts between retailers and food suppliers in the chilled ready-meal sector but instead many strategic alliances based on mutual advantage. Relations essentially take the form of a “gentleman’s agreement” and this is made possible by the structure of the industry created by the innovation network itself. Retailer A uses many small suppliers to ensure it has access to a large variety of recipes, but relies on Supplier Z for 50 per cent of its ready-meals by sales volume. As is typical with the larger suppliers in the sector, Supplier Z has a dedicated factory for Retailer A, guaranteeing confidentiality and exclusivity. This trust has enabled Retailer A to move from business plans of typically three years to longer terms of five years, and implement joint investment plans. These plans range from non-contractually based agreements in which Retailer A agrees to “deliver a volume of business to a manufacturer for five years and the manufacturer invests in a dedicated factory”, to arrangements to supply small firms with technical assistance in return for access to new recipes.

For this process to be effective the retailer must ensure that its quality standards and processes are adopted and integrated with its packaging and, crucially, own-brand marketing strategy. Information needs to be passed between the partners in this network. The “relationships in this sector are different than when you are working with the big branded suppliers as we work very closely with ready-meal suppliers and the confidences that we tell them we wouldn’t do on the branded side.” This is especially significant for small-scale suppliers (whose existence is crucial to the retailer in developing new products quickly) where the retailer is their sole client. In certain examples, retailers can help lower the asset specificity risks and information costs of suppliers by lending specialist staff, information, equipment, and money in return for dedicated investments. This series of very close relations binds the network firms into mutual dependencies whereby it becomes more profitable for firms to act without opportunism, having redefined the pay-off structures to reward co-operative approaches. In the case of large manufacturers the relationship centres on negotiation over exclusivity agreements, the use and development of dedicated manufacturing centres, and the co-ordination of new hygiene technologies and

processes, such as the development of specific packaging systems. Relations with smaller firms, many of which could be termed ‘micro-kitchens’ employing less than ten staff, were characterised more by an exchange of hygiene technician staff to co-ordinate basic standards and to transfer technological information, especially information about production systems from manufacturers, from the retailer to small producers.

Managing Consumer Knowledge

Knowledge is developed and disseminated throughout the innovation network. The *process* of working in a network is itself important knowledge. Relations in the innovation network are “fluid and dynamic” within and between firms. Retailer A’s chilled ready-meal NPD unit is part of the fresh foods division and incorporates buyers responsible for recipe development. The chilled ready-meals unit is headed by the Senior Trading Manager for Fresh Foods and has a permanent team of 26 people that includes a product development team, working on recipe development with suppliers, and 6 buyers who are responsible for the day-to-day administrative, commercial side of the business. Staff based in the chilled-ready meals unit liaise with the food technicians in the hygiene department, logistics, marketing, procurement, legal/technical department and packaging technologists. This organisation is mirrored in suppliers. The chilled ready-meals NPD unit and their supplier counterparts spend around 50 per cent of their time in each other’s firms or in other joint locations. “Some of the factories now are like large hotel kitchens, because it has become more and more specialised and the runs have become smaller” and in these cases the ongoing exchange of staff and knowledge for development and monitoring is especially important. This is of special importance in this segment, as the technical requirements of the packaging are so demanding. The NPD unit therefore co-ordinates between internal departments, external manufacturers and third-party packaging firms.[4] In the case of a micro-kitchen, Retailer A supplies access to its packaging and food hygiene and production experts through the chilled ready-meals unit and “really do work very closely together”.

INFORMATION CONTROL AND KNOWLEDGE IN THE SUPPLY-CHAIN

Retailers' control of the supply-chain differs from the open-ended relational networks that they have established for innovation, and are characterised more by formal contractual arrangements. The radical changes that have occurred in the UK grocery supply-chain have been well documented, especially from the fields of logistics and supply-chain management (Burt and Sparks, 1997; Fernie and Pierrel, 1996). By focussing on the economic relationships and drawing on our detailed interview-based research with Retailer A's internal logistics department and external contractors, we offer new insights to the processes at work. Retailers' control of the supply chain represents a sophisticated form of network organisation that is essentially one of subcontracted co-ordination. Under traditional subcontracting arrangements, the retailer devolves process and operations to a logistics subcontractor. Much of the economics-based literature on the management of the supply chain focuses on to ownership of assets such as warehouses and the mix between internalisation and externalisation (Buck, 1990; Ross, 1997; Bourlakis 1998). However, this approach underplays the changing nature of the modes of externalisation employed, as in this example the retailer seeks to resolve these problems by retaining ownership of the key assets and by controlling supplier processes and the co-ordination of information directly throughout the network via their control of the computer information system. In the following sections we will first examine the development of the supply-chain in the UK food retail industry, and following this we concentrate on examining how Retailer A's has used its control of the ICT systems to generate knowledge not only about the operation of the supply-chain but of transforming business relationships to more open-ended long term relationships.

From a Warehouse-Based to a Replenishment-Based Supply Chain

Grocery retailers in the UK have achieved control over IT-based systems of supply-chain co-ordination. This has changed the nature of the supply chain from a warehouse-based system to one whereby retailers manage their inventory on a replenishment-based just-in-time system with little stock holding. This not only enables retailers to economise on warehousing costs, but also allows them to correlate demand and supply with unprecedented accuracy. Managing the logistics of

product distribution had emerged in the early 1980s as a major objective of the food retailers in the UK (Quarmby, 1988), with the objective of centralising their logistics and distribution operations to use “logistical competency to gain competitive advantage” (Bowersox, 1998). The retailer J. Sainsbury pioneered the development of dedicated Regional Distribution Centres (RDCs) in the 1970s as an intermediate stage in the distribution process. These RDCs operated on Sainsbury’s behalf but were owned by one of the growing number of specialist distributors through a process of subcontracting whereby contractors were guaranteed fixed-term management fees. Transportation of products from the RDCs to the stores was then largely undertaken directly by Sainsbury’s own fleet of vehicles (McKinnon, 1989).

By the 1990s, the RDC pattern had become established with British food retailers, although they increasingly owned the RDCs, which they had either built themselves, or bought from contractors at the end of contract periods. In addition, retailers began to encourage the development of Primary Consolidation Centres (PCCs) to which manufacturers were able to deliver increasingly small batch-driven loads, prior to their transfer to the RDCs. These allowed very small crate (rather than pallet) based deliveries to be made. Crates can accommodate partial boxes, ideal for the delivery of very short shelf-life low-volume, high value-added products such as ready meals. The efficiency therefore does not come from standardised delivery and economies of scale. Indeed, as the logistics manager of Retailer A notes, the drawback of the system is that “you are moving more air” but the compensating advantage is derived from the degree to which it is possible to accurately match supply and demand. Larger manufacturers can co-ordinate the collection of stock from small suppliers for delivery into the PCC. Therefore, as long as the retailers use their transparent Electronic Data Interchange (EDI) and internet-based supply-chain systems to co-ordinate and control this process they can manage the supply chain from beginning to end. Under this system of organisation, the RDCs no longer carry out a warehousing function, but consolidate goods for demand-driven direct delivery to retail outlets. The distribution and logistic structure, using both RDCs and PCCs, allows small manufacturers to join the supply chain efficiently, and for large manufacturers to supply products on demand, rather than by bulk-delivery.

The mechanism by which co-ordination has been achieved is via ICT-based communication and information exchange systems. The gradual adoption of electronic point of sale (EPOS) replenishment systems in the early 1980s, and scanning technology in the mid-1980s allowed the supply chain to be managed in a more efficient way. Grocery retailers, constrained by the perishable nature of certain products, were at the forefront of the move from inventory-based systems to customer-driven systems (MacDonald, 1994). The ability to use EDI between organisations in real time is a key feature of being able to manage inter-firm systems of co-ordination (Hughes and Merton, 1996; Mason-Jones and Towill, 1998). This ability to manage the supply-chain allowed retailers to switch to customer demand-driven systems of replenishment (Smart, 1995; Winters, 1996; Fernie and Pierrel, 1996; Ody and Newman, 1991), and encouraged the expansion of their control backwards down the supply-chain. By moving their direct management backwards into the chain of logistics (Fernie and Sparks, 1998), retailers were able to gather information regarding the role of wholesaling much more effectively and to introduce their own computer-controlled stock management systems into this aspect of the value chain. By transforming information into knowledge, and cementing the tacit components of this by direct involvement in the process (such as running their own vehicles and RDCs as benchmarking operations) retailers have been able to unbundle many of the costs of services that were supplied by wholesaling subcontractors and gain much more precise information over a variety of costs that had previously been beyond their purview.

This unbundling process is especially significant. Traditional subcontracting relationships are complicated by the provision of a bundle of value-added services, asset specificity, and the problem of contractor-based risk. The ability of retailers to monitor many transactions made possible by the development of computerised information management systems significantly lowers the information costs of monitoring. This also applies, as was observed in the innovation network, to the costs of new product development when retailers are directly involved in the process. Retailer A remarked therefore that when knowledge of real costs and processes in shared between parties, co-operation is a more likely outcome although this does change the nature or power between partners. The outcome of these changes in logistics and RDC management subcontracting is a move towards open book

negotiation with retailers based on low management fees in conjunction with reward structures for efficiency improvements.

Retailer A: Leveraging Knowledge Through Supply-Chain Control

A close examination of Retailer A's supply-chain illustrates the operation of the linkages within the control network. Retailer A's logistics department is formed by a director operating with a team of four senior managers, of which one is the manager for ambient and frozen goods and one for chilled and perishable goods, responsible for the day-to-day running of the supply-chain working with a total staff of 250 employees. Retailer A's distribution network comprises of 24 RDCs and 13 PCCs as shown. The supply-chain is co-ordinated by Retailer A's hardware and software systems. Retailer A's logistics manager commented that "If you go to (Contractor O's) RDC it's our hardware even if they own the depot" explaining that this integration makes the supply-chain transparent to the retailer. "Unless you knew that RDC 2 was owned by us and RDC 12 was owned by (Contractor N), you can't see the difference … you have the same information and the computer systems dictate the processes and methods of working. Throughout the supply-chain really you have our systems." The same condition applies in the case of physical distribution, where the contractors that operate Retailer A's fleet own only 50 per cent of the RDC-to-store vehicles.

Logistics contractors explained that the transparency afforded to retailers both by the integration of their computer systems and the benchmarking provided by their own operations supplied them with a high-level of knowledge about true costs: Contractor M relating that Retailer A's "knowledge about costs is as great as ours is. There is nothing hidden there for us to extract margins from." Consequently Contractor M's management fee declined from 15 per cent to 10 per cent to 5 per cent to 2 per cent on each contract renewal. Coupled with increased information transparency, Retailer A's decision to build its own (or buy back) RDCs led to a change in emphasis in contractor's reward structures, moving from management fees based on fixed-volume freight rates to a system based on low management fees with an incentive structure for productivity gains. "Quite often it is the retailer's capital and the fee therefore becomes two tier – a fixed fee and then a sum of money that is deliverable in addition if service or costs are improved." This profoundly alters the

nature of relationship between retailer and contractor, and this can be observed in longer contract lengths - Retailers A's contracts with Contractor M having increased from two to five years. Within this longer-term relationship Retailer A and its suppliers pool information on real incurred costs during negotiation in order to arrive at mutually acceptable distribution of costs and profits, with the retailer sometimes finding that contractors actual costs were higher than its own predictions and adjusting rewards to account for this. As a result of this framework, the close relations enable Retailer A to use fewer contractors in more trusted mutually advantageous relationships – indicated by the fact that only two contractors are responsible for managing six out of their eight externally-managed RDCs.

In their management of the RDC-to-store supply-chain, retailer A negotiates contracts with third-party logistics firms to manage specific RDC management contracts. These suppliers are third-party logistics firms.[5] The PCC network is significantly different from the RDC network, and less under the direct control of the retailer. The PCC exists to allow larger manufacturers to make smaller, more regular demand-driven deliveries to RDCs, and to bring smaller suppliers within the supermarkets supply-chain, allowing infrequent deliveries of products or regular deliveries of small loads This capability is critical for chilled foods because the production volumes on some lines are already relatively small, in the case of Retailer A 90 per cent of products selling less than 6 units a week per store. Large and medium food manufacturers with their own distribution systems (such as Northern Foods and Geest) and small regional logistics companies are in the ideal position to collect small crate loads from suppliers and make consolidated deliveries into PCCs. This is only efficient if these small loads are consolidated for multiple retailers, so Retailer A's logistic manager's "job is to go round and convince the suppliers that it is in their interest to become part of this network, because [Contractor O] is not just going to a supplier and picking up for us but for Retailer C and Retailer D as well". The composition of the PCC network means that it is regionally constrained and local in nature. In operational terms this means that Manufacturer X's Midlands PCC is run by Contractor O, which collects all the goods from the suppliers in the Midlands and delivers to the 8 regional RDCs, but whose range is confined to 1 – 1½ hours road time from its base RDC. For Retailer A this means that managing and extending the PCC network entails recreating and managing many relationships with local firms. As

in the innovation network, Retailer A manages multiple relationships with suppliers and adds value by central co-ordination.

Information Exchange and Innovation

Through POS information, retailers respond to demand by ordering from their suppliers the stock needed to fulfil or, increasingly, anticipate demand. Orders are passed directly to suppliers' computer systems through the EDI / internet supply-chain network, where they are tracked by the retailer's control of the IT information system through primary and secondary consolidation points before delivery to individual outlets. This control over the supply chain is fundamental to the existence of the chilled ready-meal market, as it allows retailers to correlate supply with demand (vital for extremely short-life products where wastage tends to vary between 20 to 40 per cent of output) through the delivery of small batches and allows small specialist suppliers to be incorporated into the supply chain. The transparent information system co-ordinating the supply chain has changed the nature of relationships, and the potential structure of linkages, between manufacturers and retailers. Integration of the information network allows retailers to work more closely with suppliers and contractors than typical contractual models suggest. The POS data is the critical information that drives the supply-chain, and is tightly controlled by the retailer. This is because the POS information can be exploited not only to match supply and demand, but in the case of chilled ready-meals, to develop and innovate new products for markets revealed by this data. The potential for close relationships in the supply-chain allows retailers to form networks with firms that own complementary assets and the knowledge to exploit the revealed consumer demand in terms of supplying and innovating new products.

CONCLUSION

It is clear that the increasing use of integrated generic ICT systems is having a profound impact on the organisation and activities of firms, both in terms of the scope of control that they have over the value-chain and in the way in which they are able to build up detailed consumer information. The systems concerned here are generally

generic supply-chain systems and data processing systems which were designed in order to manage the process of efficient inventory management and warehousing, eventually becoming more sophisticated and facilitating a move towards just-in-time systems and consumer demand prediction. In the example offered by the UK food processing and retailing sector, supermarkets have been able to control and co-ordinate activities through their control over the supply-chain and consumer information. The nature of the competitive process in this industry has thus been substantially modified by these systems, not so much by their introduction but by their subsequent application as drivers of both innovation and quality-based differentiation.

Significantly the shift to ICT systems encompasses computer-mediated retail where ordering can be made online and the supply-chain extended to individuals customer's houses. Whilst home-delivery and internet shopping is likely to play an increasingly important role in the development on shopping behaviour (Dennis, Harris and Sandhu, 2002) of the grocery retail sector, however, the ultimate impact of this remains uncertain despite the high profile which has been afforded to these systems. In contrast it is apparent that the competitive structure of the industry has been changed due to the implementation of generic ICT systems. Initially, supply-chain management systems enabled supermarkets to both integrate new firms into the supply-chain, and create competitive advantage through linkages with complimentary firms in order to innovate new products. Even more significantly, grocery retailers have been able to integrate consumer-demand information from consumers at point-of-sale into their information systems. Crucially it is the ability to gather and analyse consumer buying patterns and trends through POS data collection, loyalty card information, internet order histories and subsequent data mining which has driven both the shift to just-in-time ordering and stock control systems and of the ability of retailers to target smaller target markets more accurately. This ability to reveal and satisfy consumer demand has ultimately enabled supermarkets to engage in the development and supply of new products using vertical network arrangements with supplier firms.

One major impact of the control of inventory management systems through the supply-chain has been to extend the reach of supermarket chains through the

distribution process and has enabled them to exert a significant degree of control over the strategies of food producers and manufacturers as well. Coupled with the major UK multiples ever-increasing share of the grocery retail market and proximity to the consumer, supermarkets appear to be increasing their power over the food retail and manufacturing sector including the perceived ability to charge excess prices. This perception resulted in the Office of Fair Trading launching an investigation into the activities of supermarkets by the Competition Commission. A critical finding of the Commission's report completed in 2002 was the acceptance of the growing importance in the food processing and retailing industry of ECR (Efficient Consumer Response). This involves both supply management, through continuous replenishment and automated store ordering, and demand management in which retailers and suppliers jointly manage product categories. Both of these activities are based on the use of information systems of the kind discussed in this paper (Competition Commission, 2002:241-3). The shift made possible by the detailed consumer information gathered by supermarkets is therefore not only enabling them to exert greater power over other actors in the value-chain in order to drive their costs down, but to also charge premium prices to targeted consumers through the supply of high margin goods. This ability may also offer some explanation as to persistence of the high profits earned in the UK by grocery multiples in comparison to grocery retailers in other markets.[6]

In conclusion, the ability of firms to collect and then effectively exploit consumer information about demand and preferences is becoming a key aspect of competitive advantage. For firms in consumer-driven sectors such as retailing the control of this information has also strengthened their position within the industry, and enabled them to extend the number of suppliers within the industries value-chain through the use of networks in order to meet customer demand for new products. The control of the information systems needed to co-ordinate inventory and the movement of goods through the supply-chain has also enabled the firms to initially collect consumer information and to leverage this information by combining consumer information with the ability for highly co-ordinated product supply. The convergence of discrete systems into an overarching system creating an information network controlled by supermarket retailers from final consumers to food manufacturers could be considered an e-business system that has in this instance created a new competitive

structure. As Palmer (2002) has recently argued, it is the successful integration of different elements of ICTs into novel systems of operation, qualitatively distinct from previous forms of activity in the sector, which constitutes the essence of the e-business revolution.

ENDNOTES

[1] Because of the sensitive nature of competition and inter-firm relationships in the industry, we are not able to reveal the names of the companies and individuals who helped with this study.

[2] For example, one of two managers interviewed at contractor A had worked in a similar role for both retailer C and supplier B, and retailer A's logistics manager had worked previously for retailer C.

[3] Whilst own-label products are lower-price alternatives to those of branded manufacturers (Burt and Sparks, 1997), own-brand goods are innovative products developed *by the retailer* (Fernie and Pierrel, 1996).

[4] In the case of larger manufacturers packaging is managed specifically for each customer, and often through third-party specialist firms as well. Where large manufacturers do produce packaging this is in close development with the retailer's hygiene, marketing, procurement and packaging departments through the chilled ready-meal NPD unit.

[5] The main suppliers are: Exel Logistics, Christian Salversson, NFT, BOC Transshield, Tibbet & Britten, and Wincanton. Tibbet & Brittan was formerly Unilver's internal logistics division, and BOC Transhield was established as a joint-venture between BOC and M&S to develop the chilled supply-chain.

[6] The apparent high profit levels of UK food retailers in comparison with European and US retailers has been the subject of hot debate (see Burt and Sparks, and Harvey, 2000 for a reviews), The issue of why UK retailers have higher profit levels is complex, but own-brand margins are a contributing factor (Burt, 1992; Burt and Sparks, 1997).

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